

Novochizol™ copper formulations against mildew

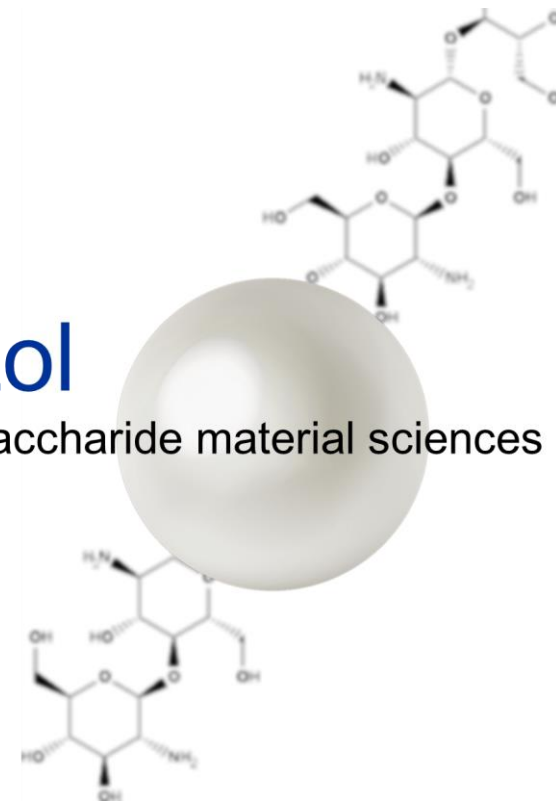
Who is doing what?
Progress report 2022



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Novochizol

First-in-class polysaccharide material sciences



Outline

What is Novochizol?

Novochizol: just a “better” chitosan?

Novochizol copper formulations: how we do it?

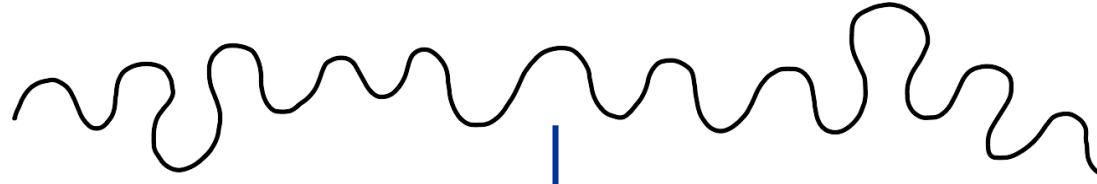
Novochizol copper formulations: «less copper» works, but why?

Next steps

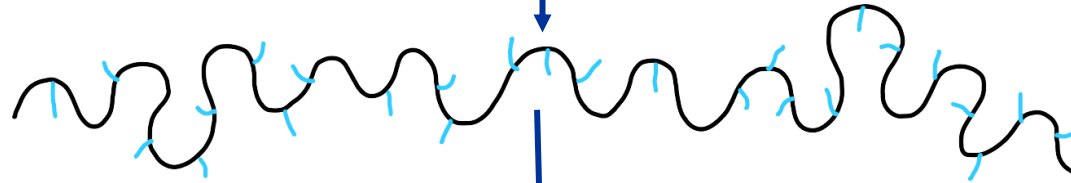
The bigger picture: «precision» chitosans for reliable plant protection

What is Novochizol?: cross-linked monomolecular chitosan

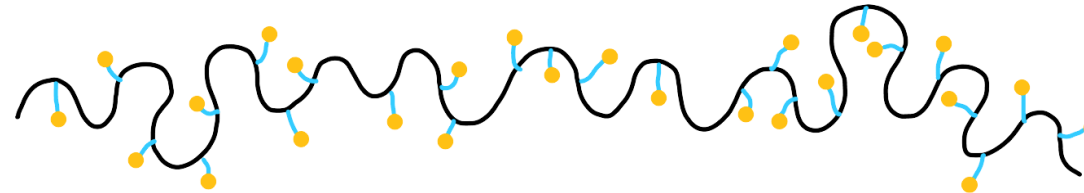
Chitosan



Cross-linking agent



Activation



Intramolecular
cross-linking



Novochizol

First-in-class polysaccharide material sciences

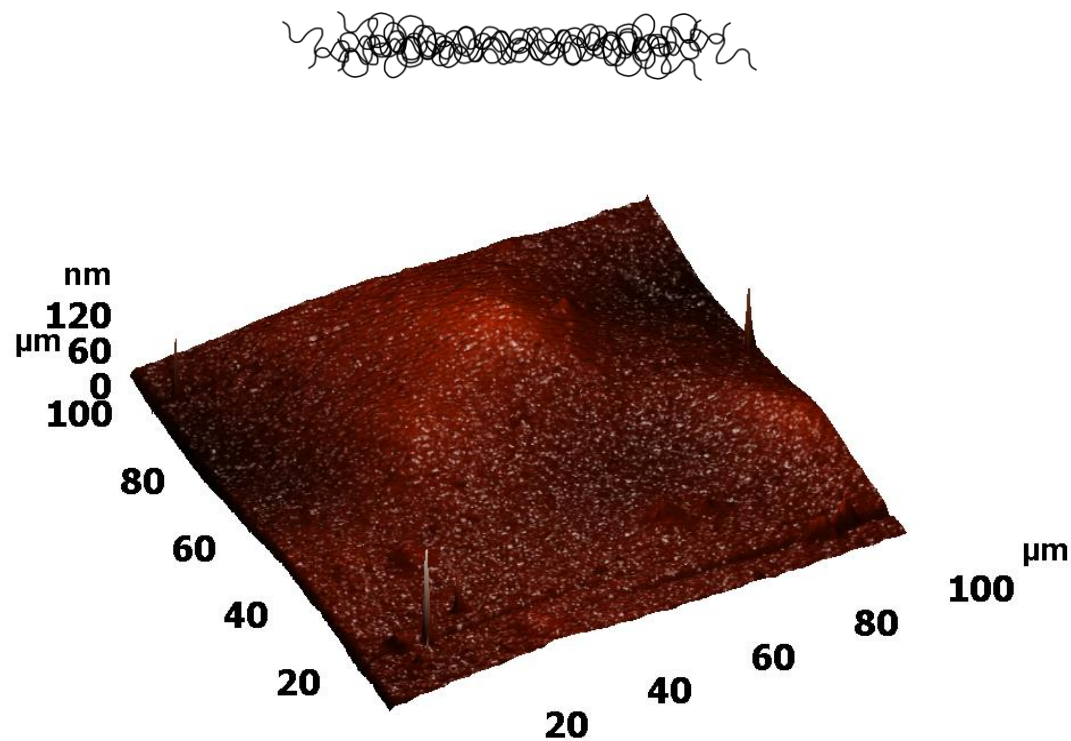


90%+ yield
robust
reproducible
scalable

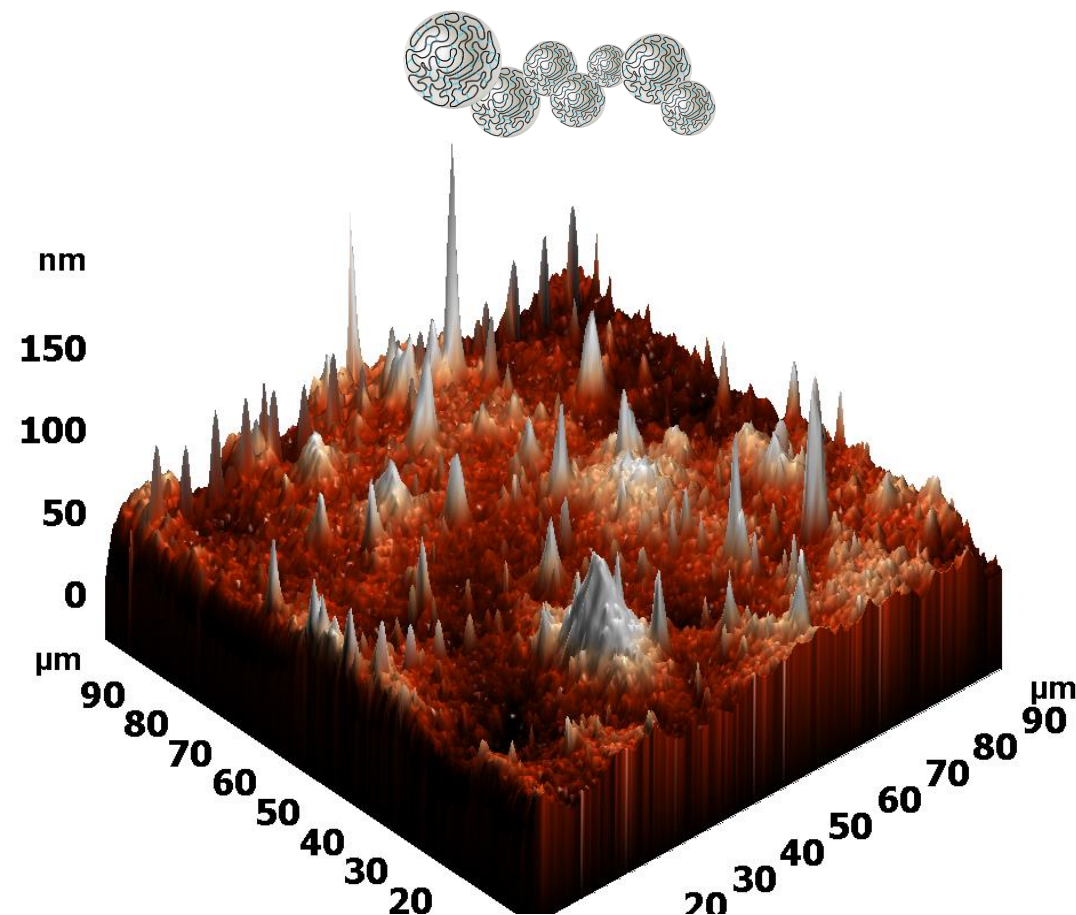
From chitosan to Novochizol™ (atomic force microscopy)

100 μm x 100 μm AFM surface scans of chitosan and Novochizol (dehydrated deposits)

A. Chitosan(substrate)



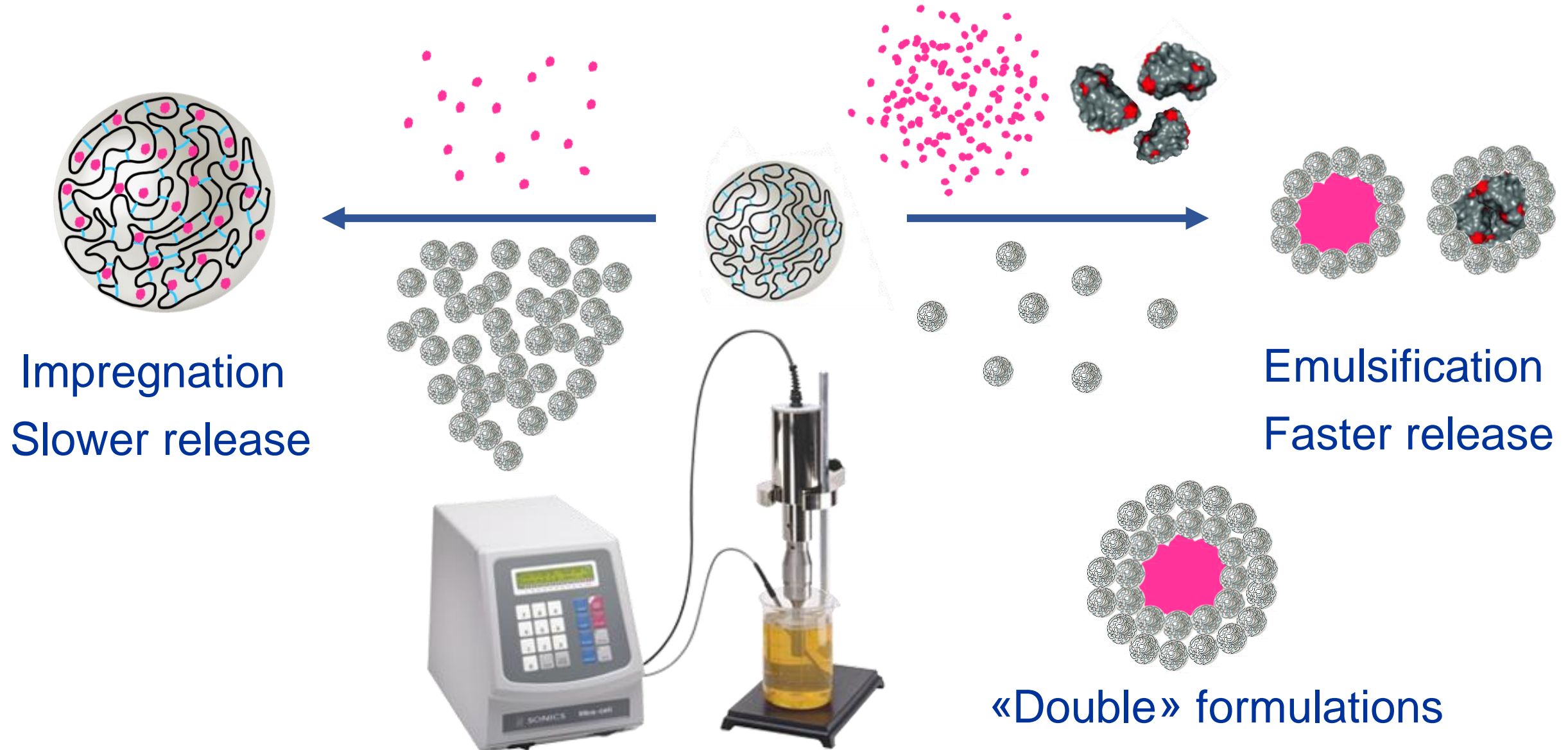
B. Novochizol (product)



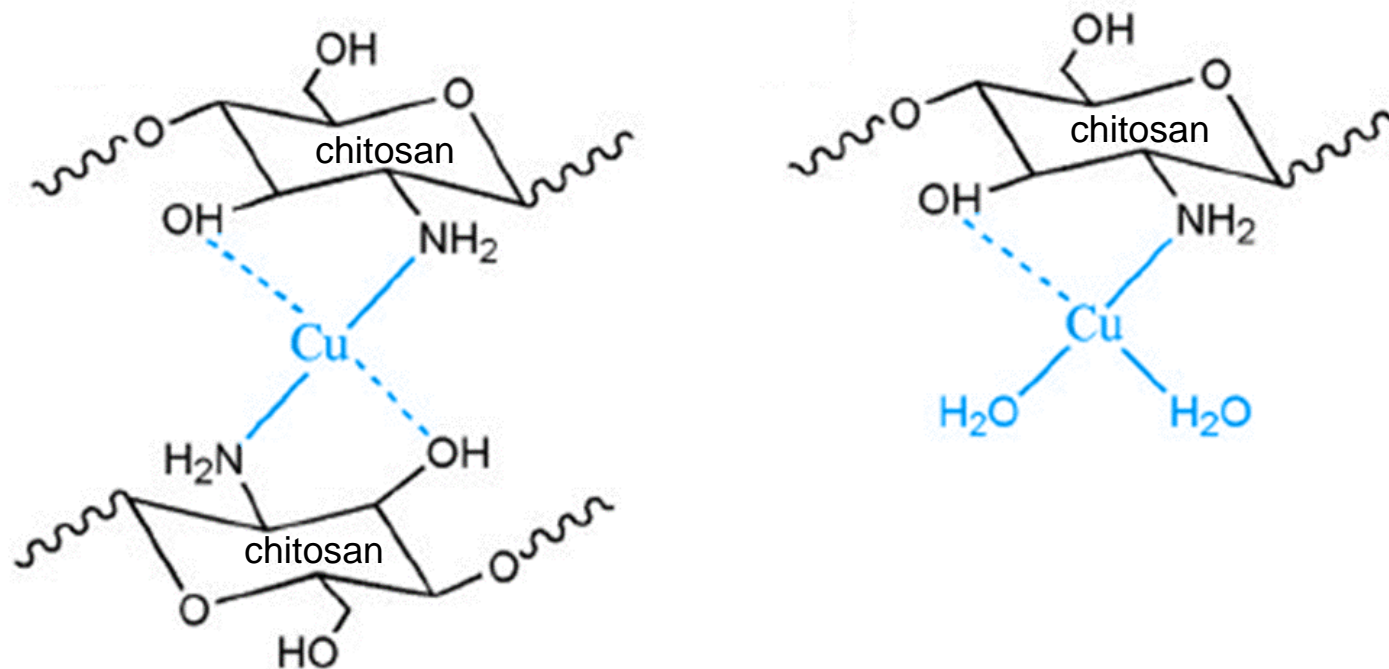
Novochizol: just a “better” chitosan?

	Chitosan	NOVOCHIZOL™
Solubility (pH < 6)	Only soluble at pH<6	Soluble suspension at all pHs
Viscosity	high	low
Biodegradability	fast	slow
Chemical/physical stability	low	high
Physical state(s)	modifiable only through chemical reactions with other compounds.	modifiable by changing degree of cross-linking.
Formulations	limited, complex?	small molecules (copper, sulfur) DNA, RNA, peptides, proteins viruses and microorganisms

Novochizol copper formulations: how we do it?



Copper and chitosan: an old couple...



Estimated adsorption capacities:

138.0 mg g⁻¹

276.0 mg g⁻¹

Novochizol™ ?

Insoluble
copper
chitosan
complexes



Sustained
release of
cupric ions



In the right
range



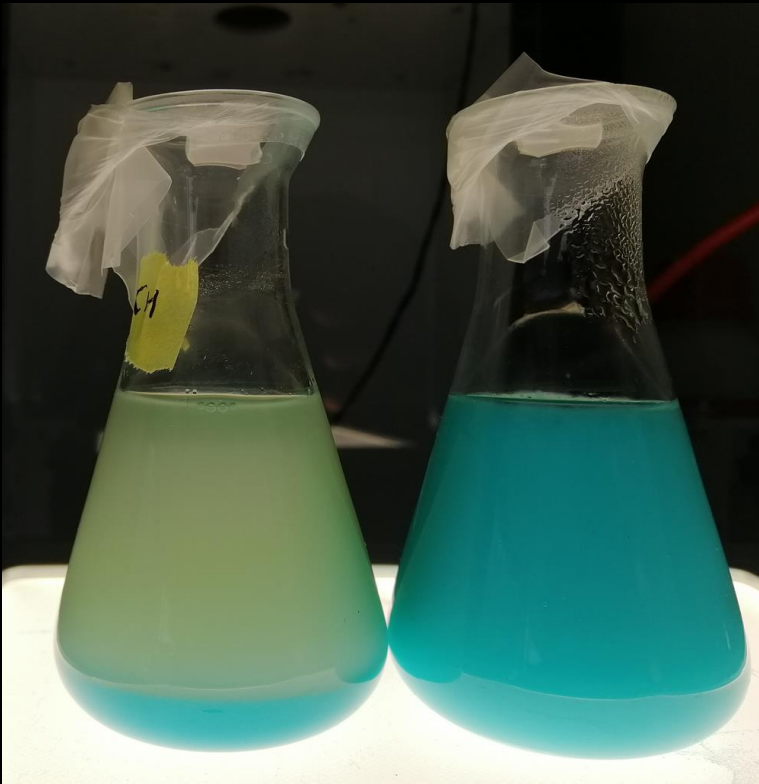
Dose
reduction



The case of copper sulfate

(200 mg Cu⁺⁺ per g chitosan or Novochizol)

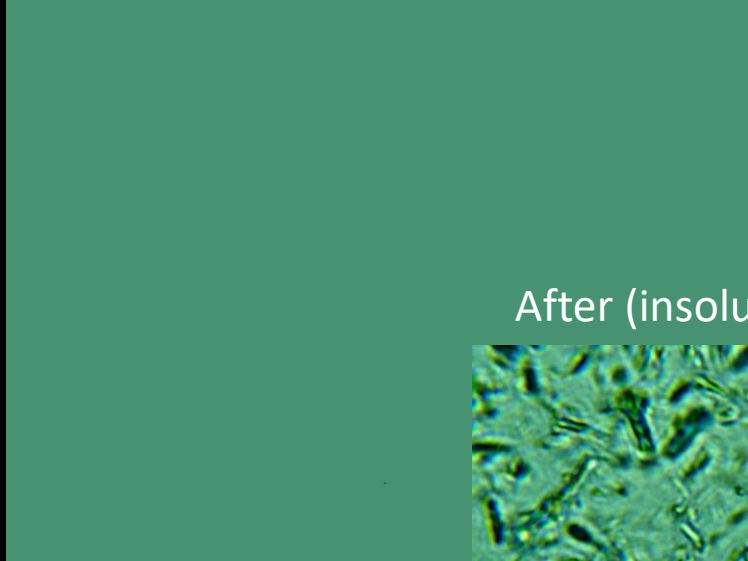
After 24 hours



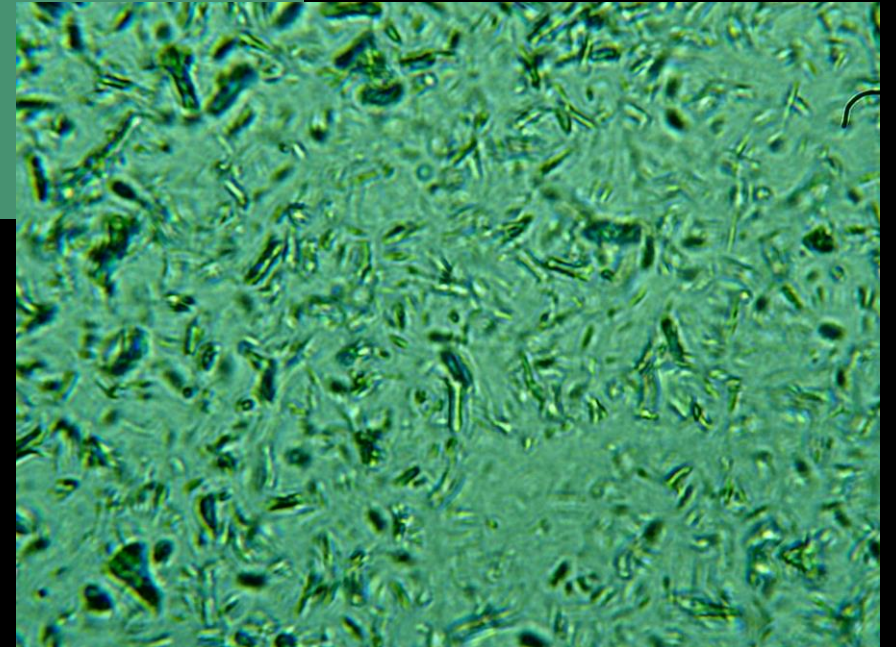
2% chitosan

2% Novochizol

Before (soluble)

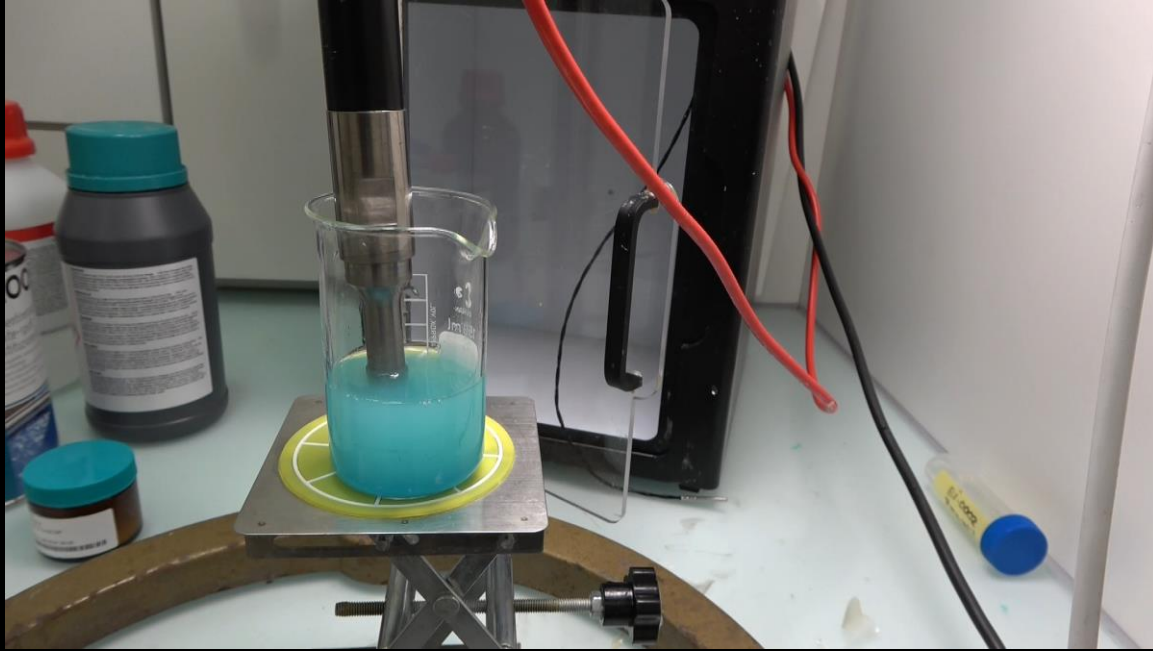


After (insoluble, particles of about 10-15 μm)

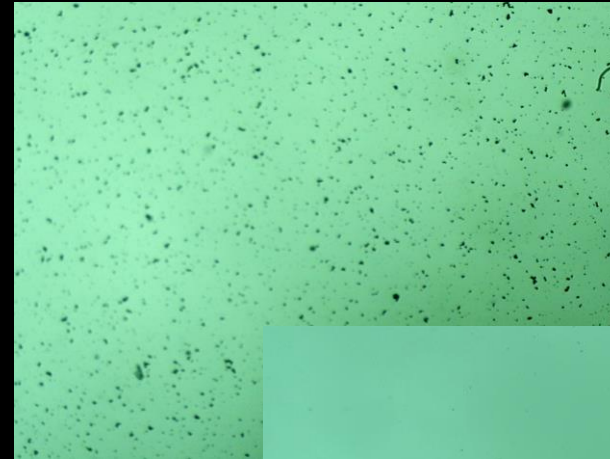


10 μm

The case of copper hydroxide (1 % Novochizol, 200 mg Cu⁺⁺ per g)

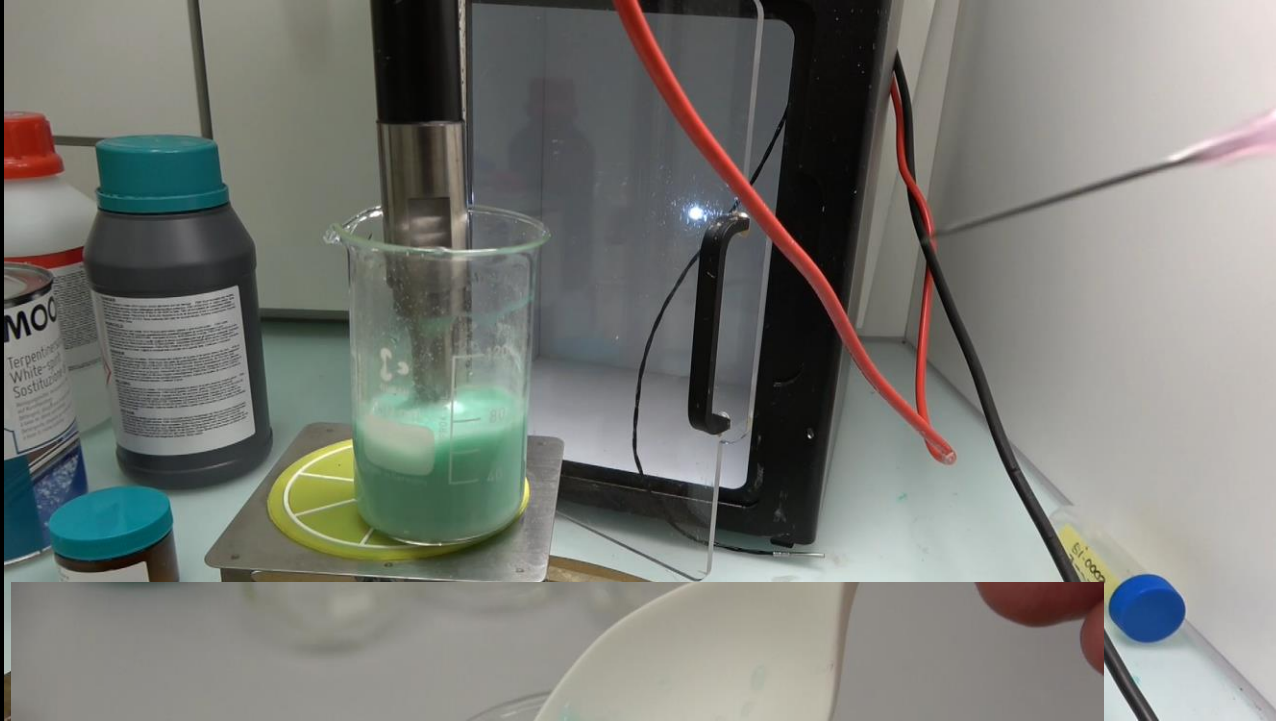


Before (insoluble powder)

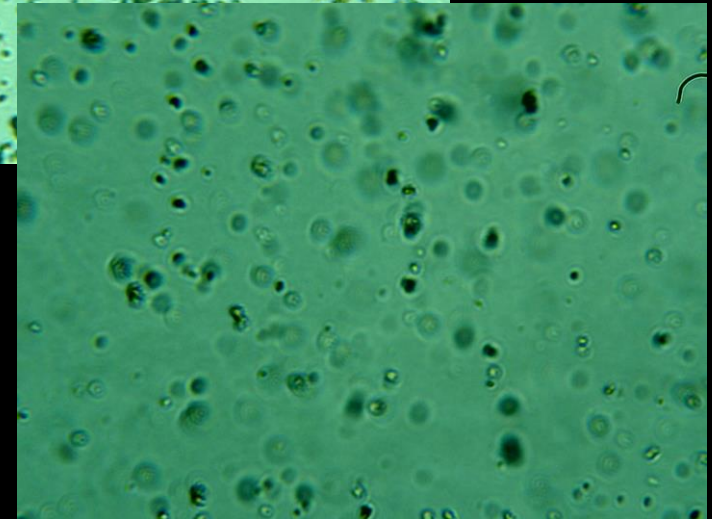
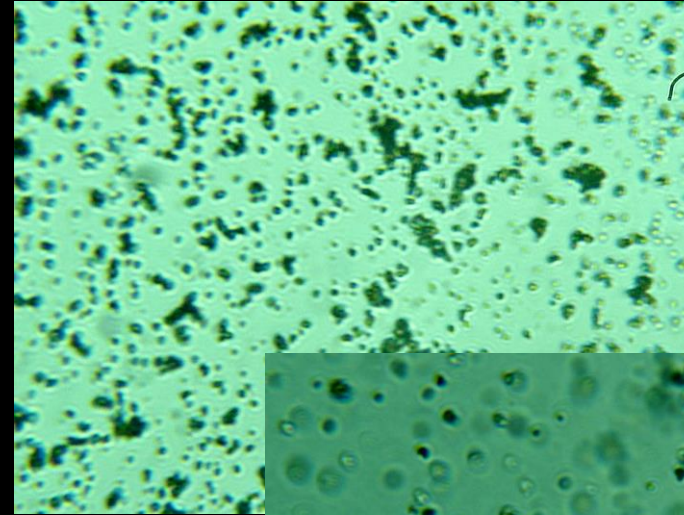


After («Soluble» suspension < 1 μm)

The case of copper trihydroxyl chloride (1 % Novochizol, 200 mg Cu⁺⁺ per g)



Before (insoluble powder)

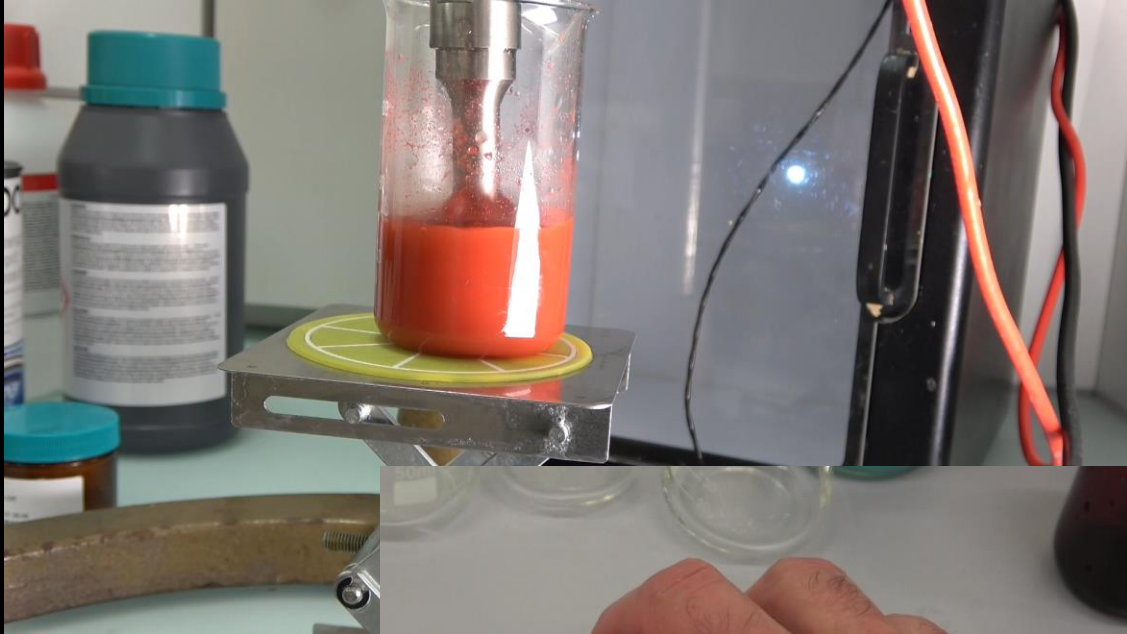


After («Soluble» suspension)

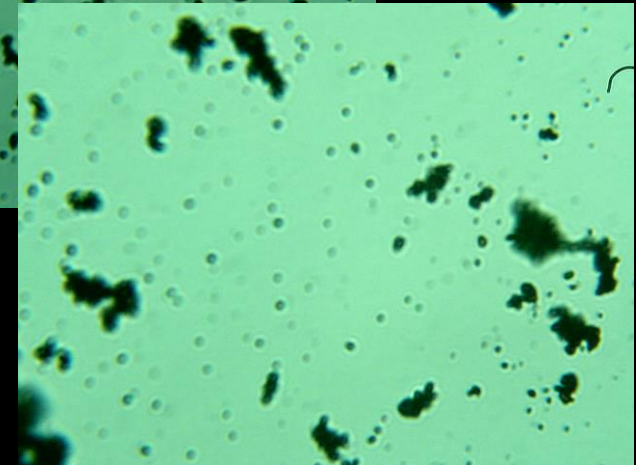
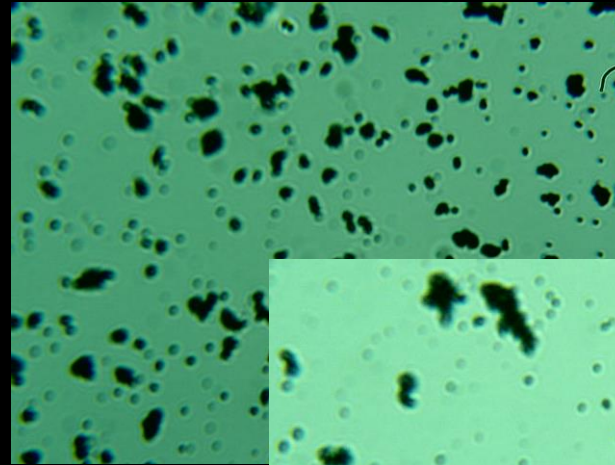


The case of copper (I) oxide

(1 % Novochizol, 200 mg Cu⁺⁺ per g)



Insoluble



After («Soluble» suspension)



Master thesis research project: Novochizol for copper dose reduction



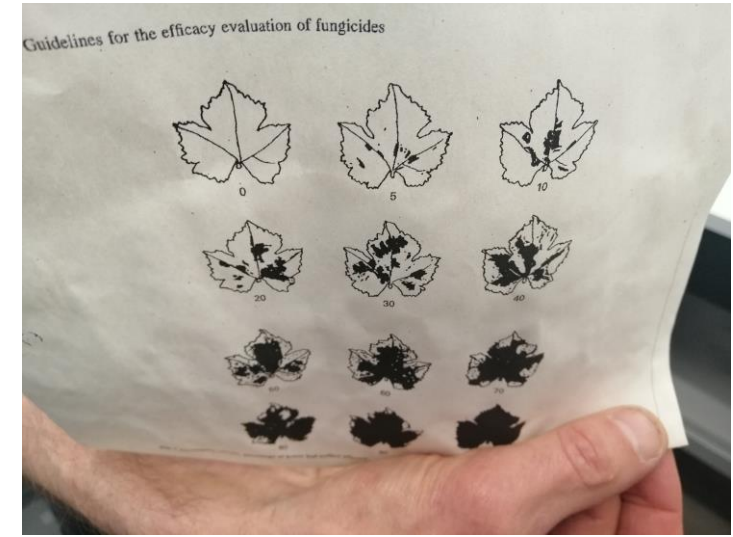
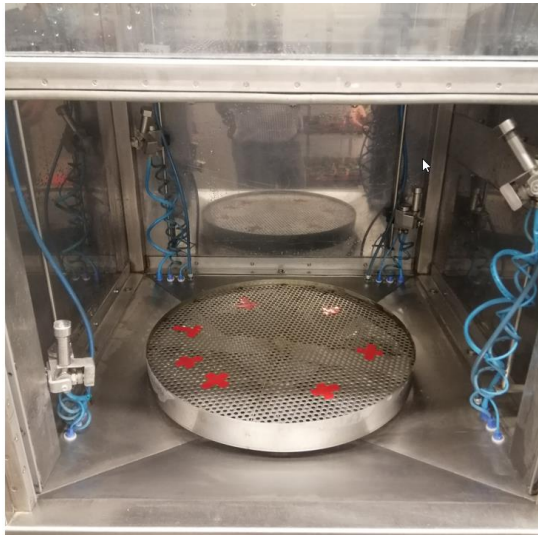
Cécile Luterbacher,
winemaker and MSc
student



Haute école
spécialisée bernoise

FiBL

Master thesis research project: Novochizol for copper usage reduction



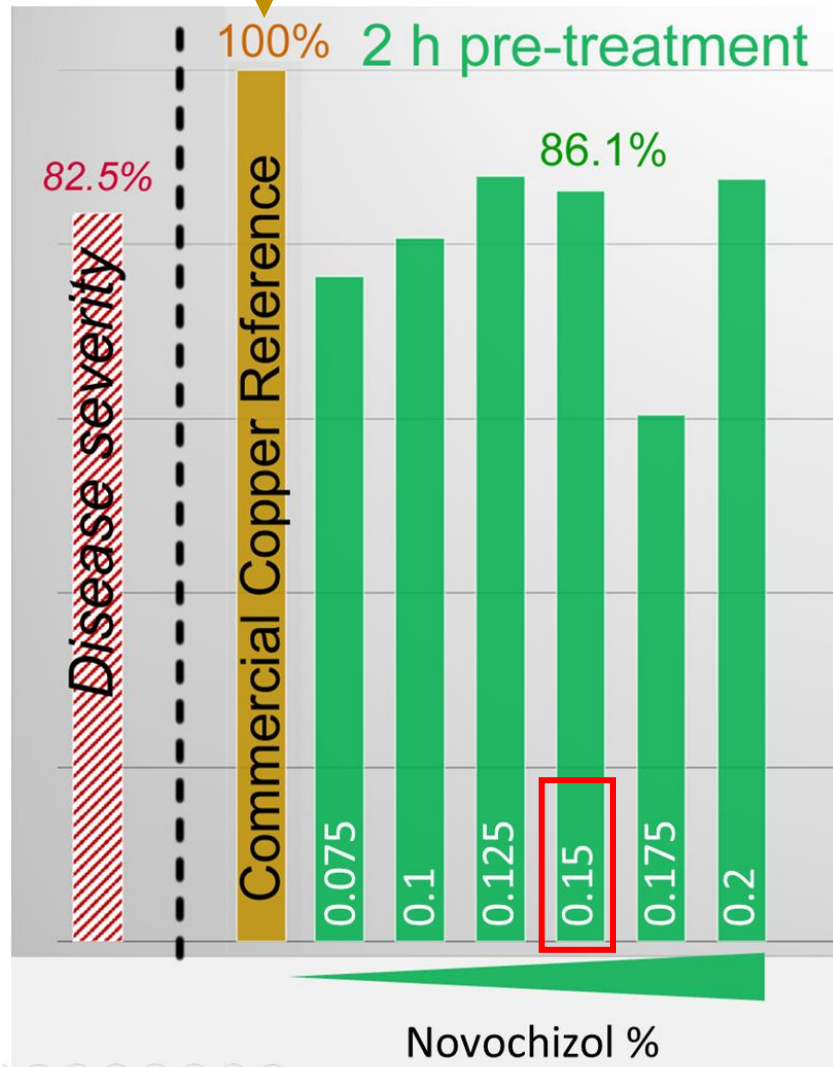
Ligerz
Weinbau,
Bielsee



FIBL test
plots,
Frick, Aargau

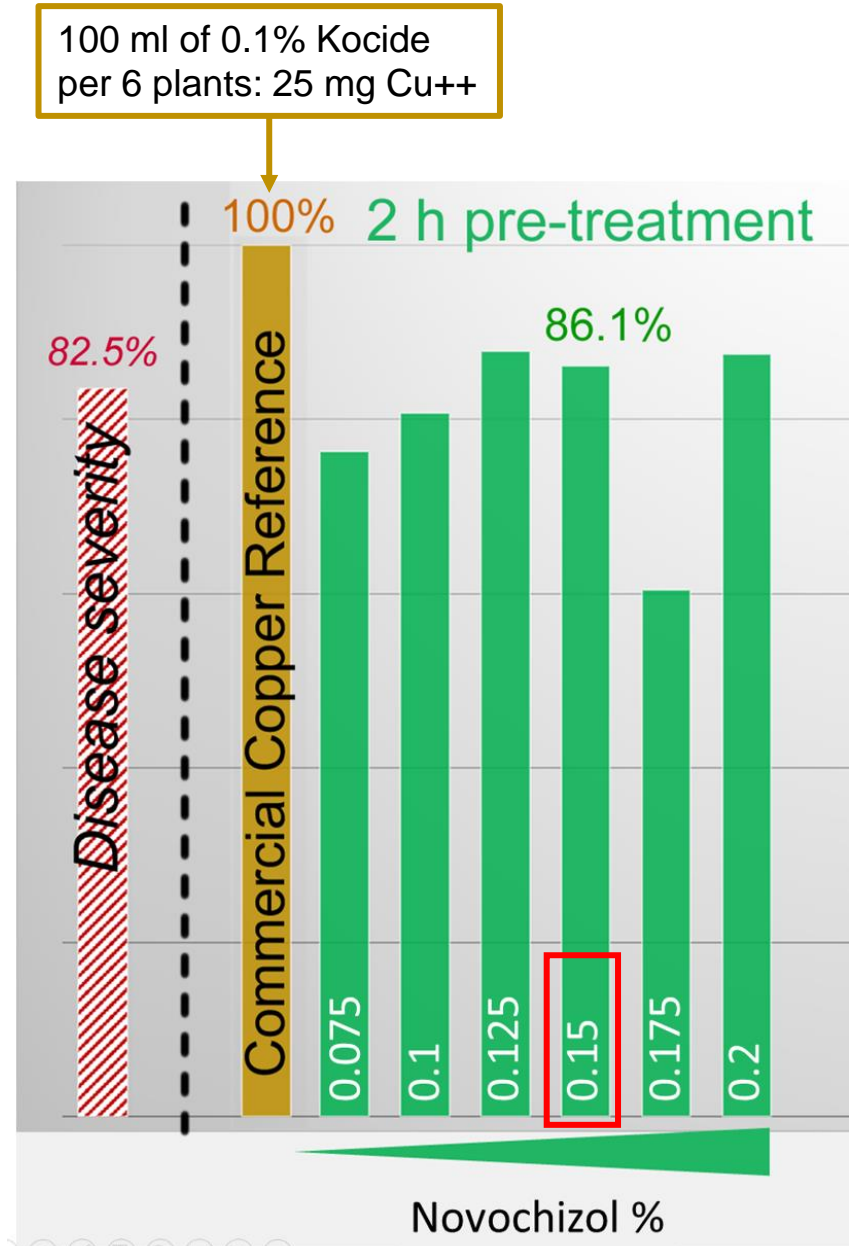
Novochizol alone:

100 ml of 0.1% Kocide
per 6 plants: 25 mg Cu⁺⁺

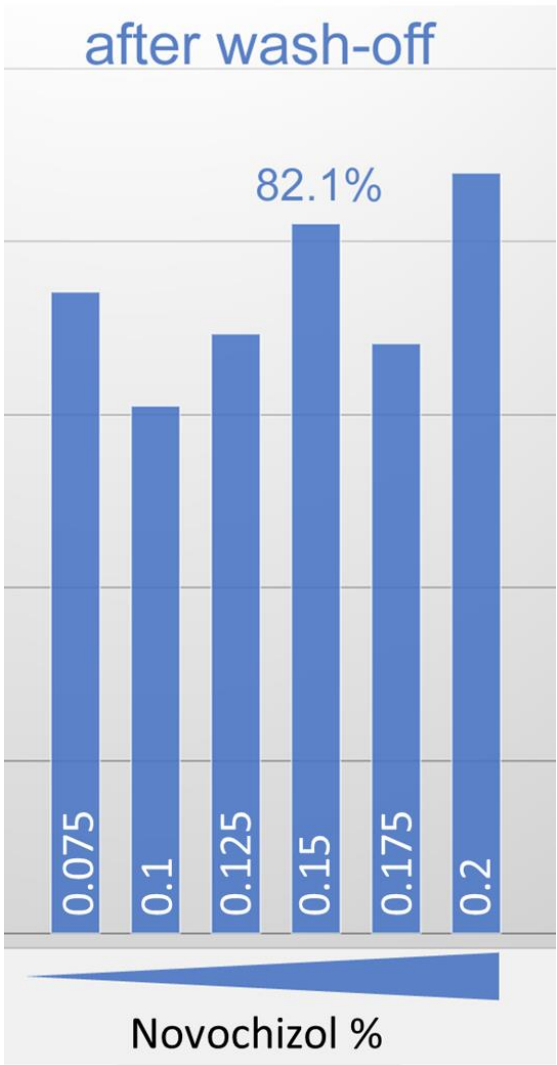


- Significant anti-fungal activity
- Bimodal dose response
- Optimal concentration set at 0.15% Novochizol

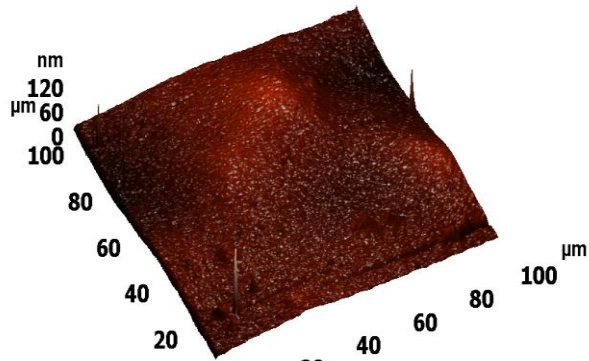
Novochizol alone: resistance to mildew infection



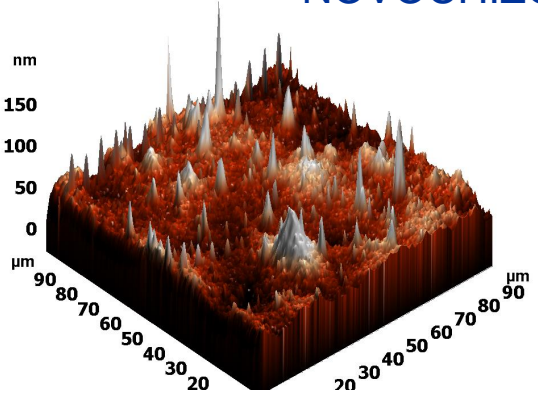
Better adherence



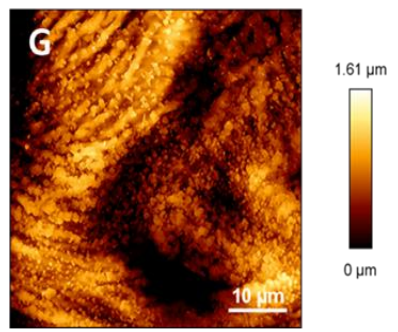
Chitosan film



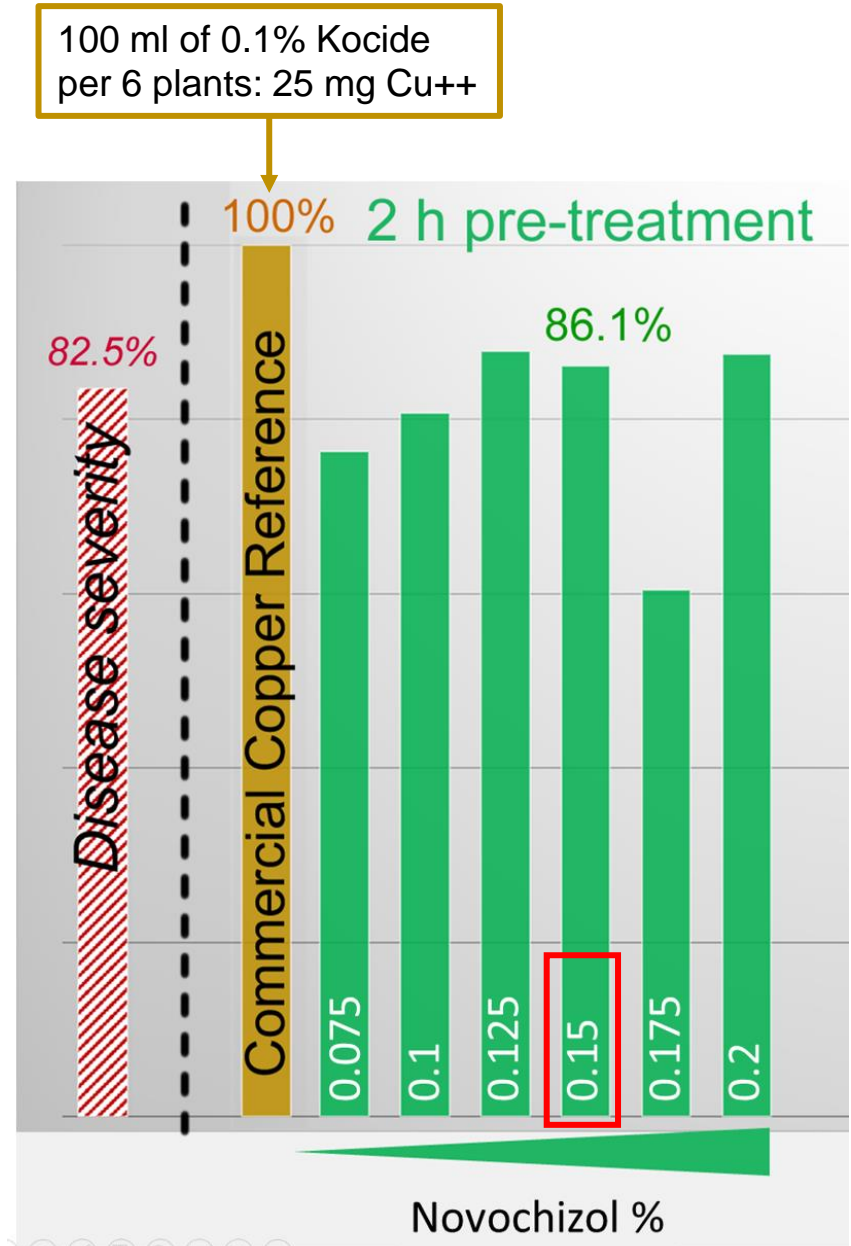
NOVOCHIZOL film



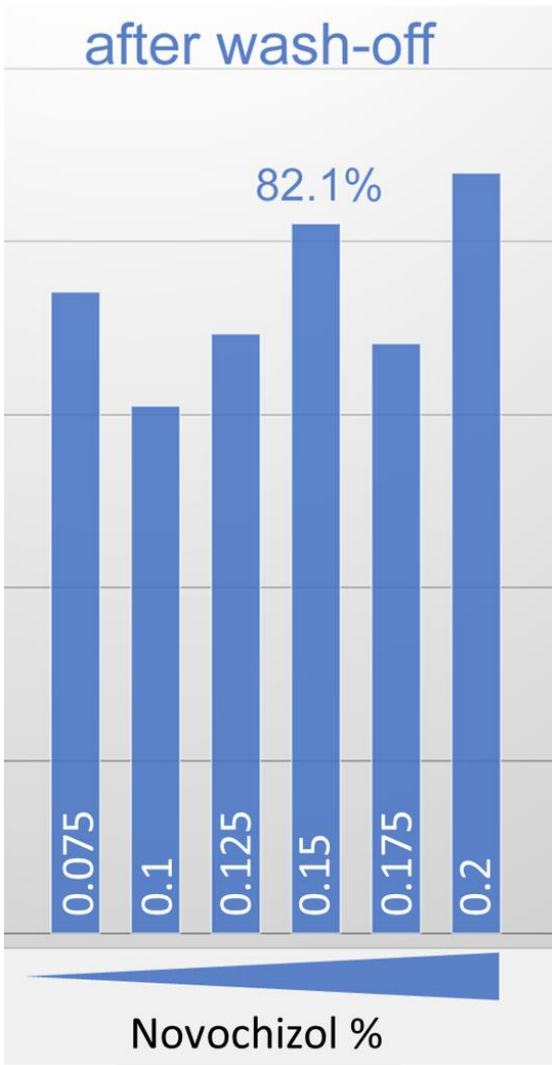
Surface of a grapevine leaf



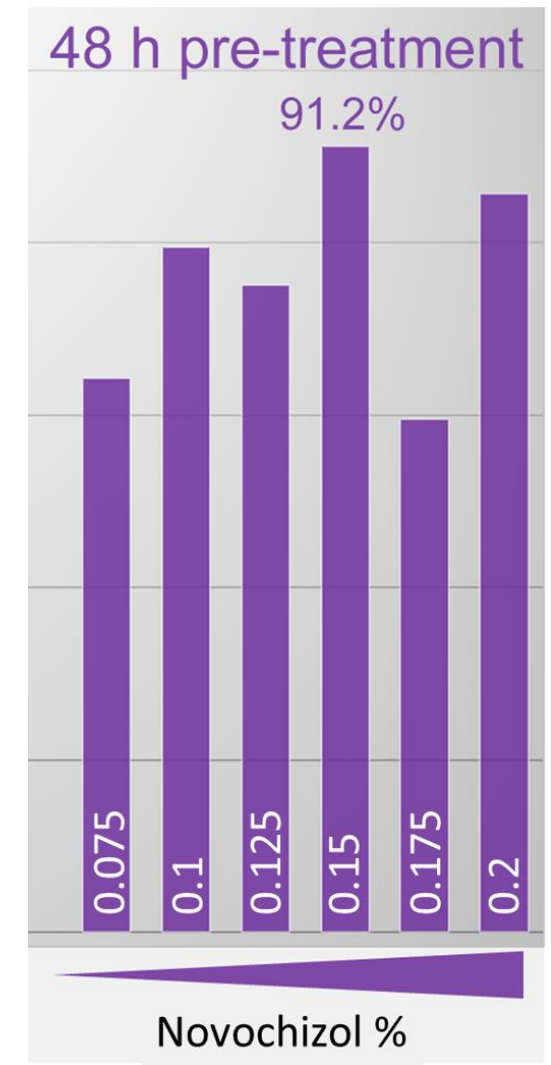
Novochizol alone: resistance to mildew infection



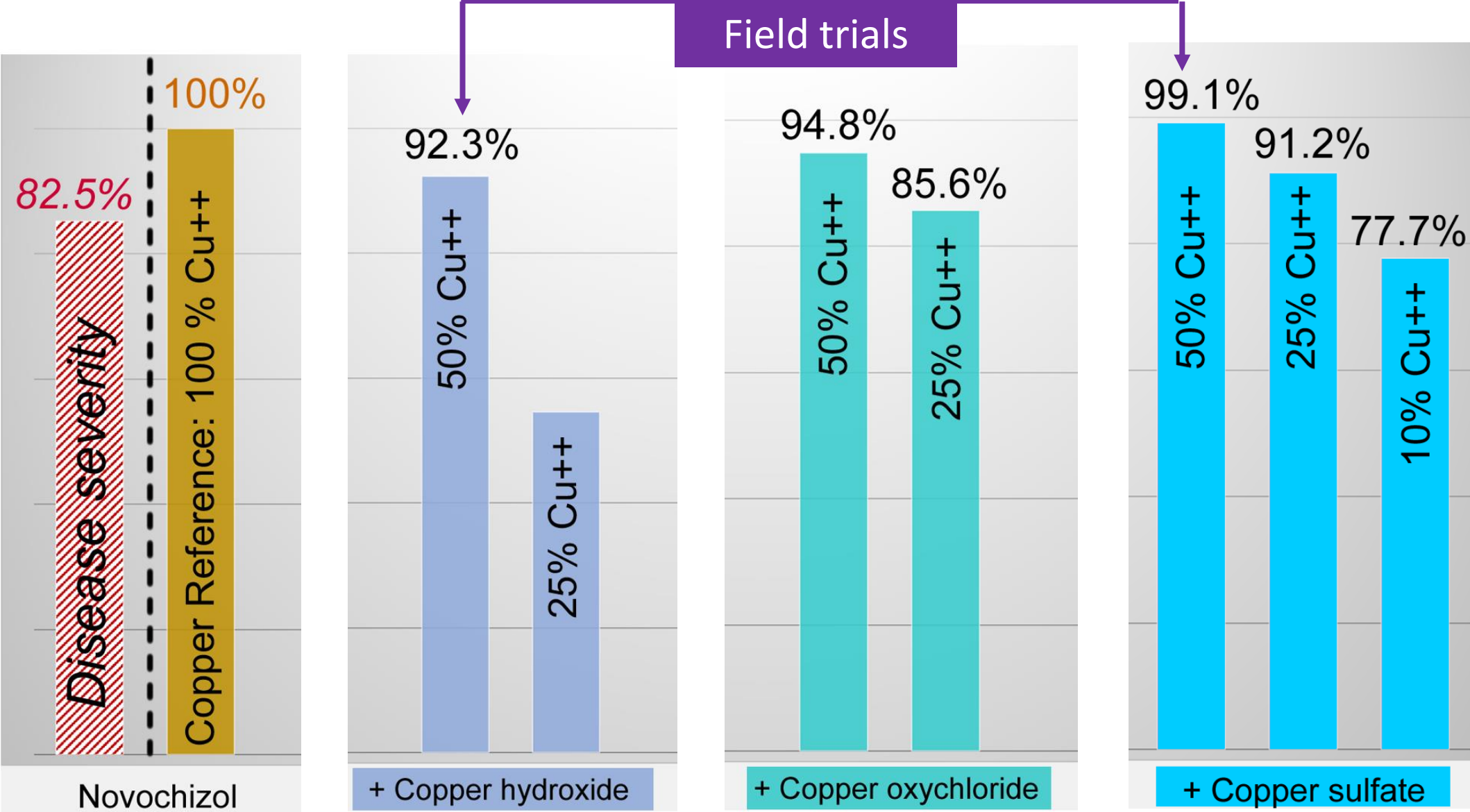
Better adherence



“Early” treatment OK



Novochizol-copper formulations: resistance to mildew infection



Significant copper dose reduction (50% or more) appears possible

Field trials: What a terrible year..... 🍌



Ligerz Weinbau,
Bielsee
**No infection
anywhere**



FIBL plots:
Untreated control:
“full” infection
All treated plots:
“zero” infection

Next steps

1. Novochizol copper formulations: who is doing what?

1. Novochizol direct antifungal activity
2. Stimulation of plant defenses
3. Better delivery of copper
4. Additive or synergistic effects of any combination of 1,2,3

2. Optimised formulations

3. More field trials

4. Other cultures /trials Olive leaf spot (*Venturia oleaginea*) in Mallorca

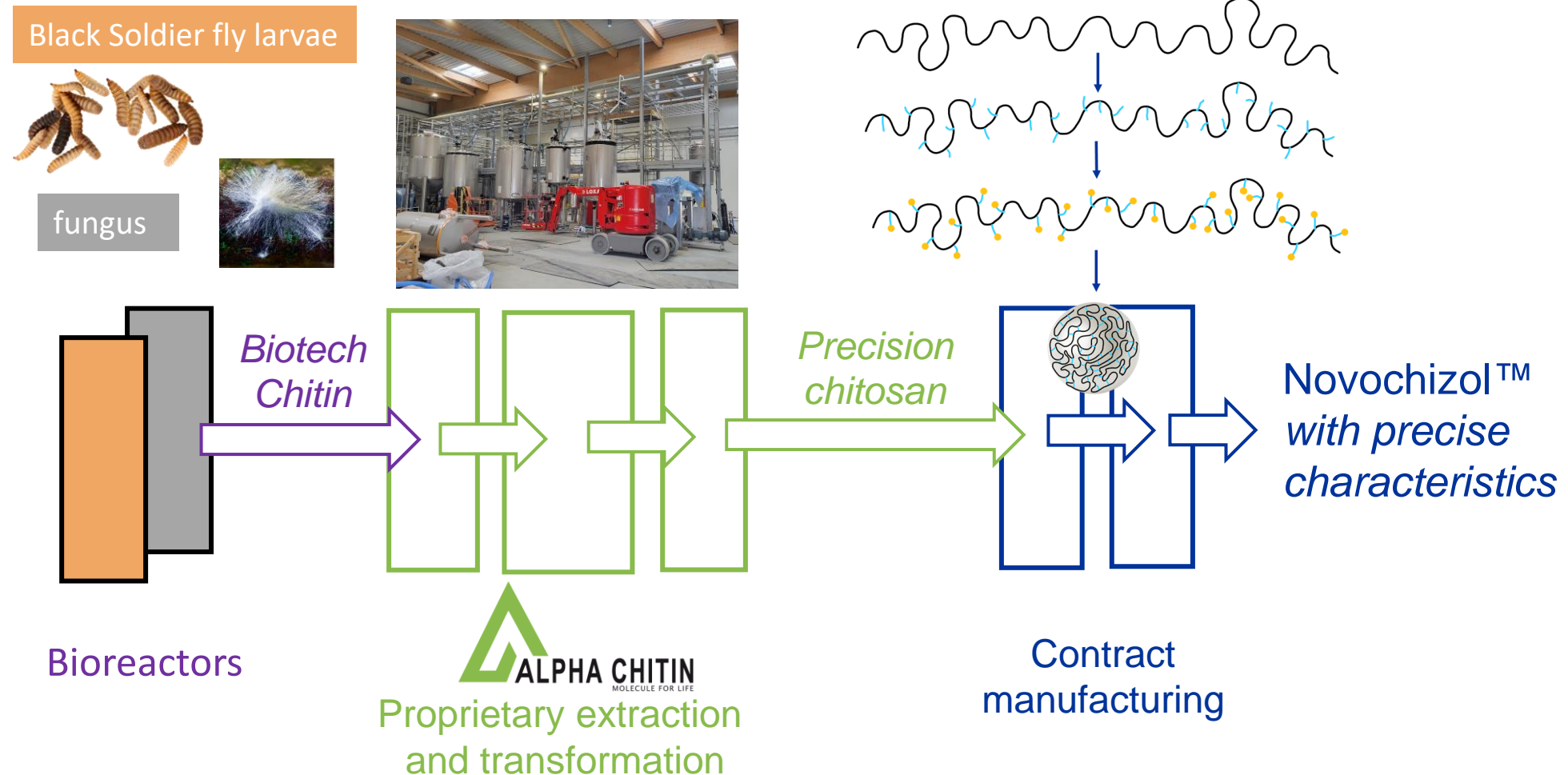
5. Collaborations: better chitosans for plant protection



UNIVERSIDAD DE CÓRDOBA

Novochizol™ manufacturing: Joint venture with Alpha Chitin

- Alpha Chitin is a new, industrial producer of chitosans using **new technologies**
- Bio-sourcing, full traceability and **green chemistry**
- Multiple specifications **and guaranteed batch-to-batch reproducibility and traceability**
- Contract manufacturing of Novochizol™: **projected annual capacity of 50 tons** in 2024





Thank you for your attention

www.novochizol.ch

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